

Electric Transportation Technologies and Equipment

Zero Emissions

Reduced Energy and Operating Costs

Increased Flexibility for California Business



December, 2004

Electric Transportation: Many and Diverse Technologies



Electric Transportation Benefits

- **Reduced criteria pollutants**
- **Reduced toxic air contaminants**
- **Reduced greenhouse gases**
- **Reduced petroleum dependence**
- **Lower energy costs for consumers**
- **More compliance flexibility for business**
- **Lower compliance costs for business**

Electric Transportation Market Drivers

- **Varies by Technology:**
 - Air Quality Regulations & Incentives
 - Indoor Air Quality
 - Economics
 - Technological Developments
 - In Future: GHG and Petroleum Dependence Reduction
- **Some electric technologies have significant market share; over 300,000 non-road electric vehicles in California.**
- **Future potential is large, as are benefits to California**

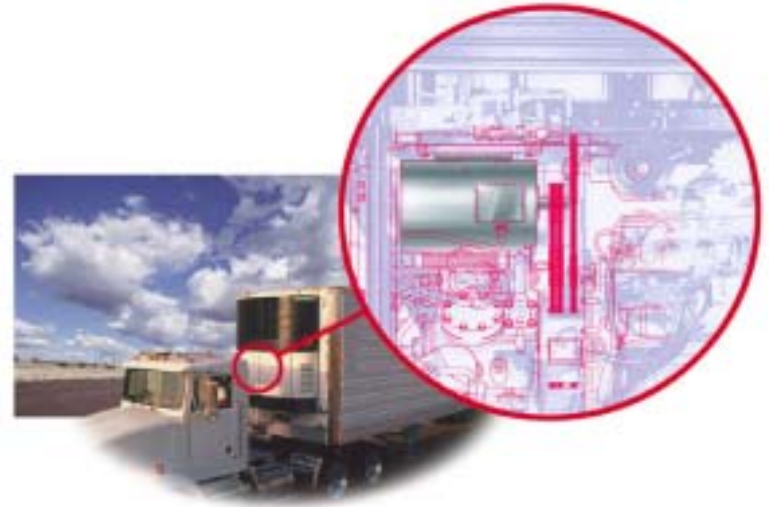
Truck Stop Electrification

- **About 67,000 sleeper cabs in CA**
 - Idle at truck stops up to 16 hours/day
- **The Solution: TSE**
 - Off-board HVAC & electricity
 - Shore power (120v/240v) with onboard HVAC
- **2010 Potential**
 - Additional emission reductions: 29.5 tpd NOx and ROG
 - Displace 45 million gals. of diesel annually



Electric Transport Refrigeration Units

- e-TRUs plug in at dock, use diesel on road
- About 4,000 – 7000 e-TRUs in California
- 2010 Potential
 - Additional emission reductions:
12 tpd NOx and ROG
 - Displace 30 million gals. of diesel annually



Marine Terminal Electric Technologies

- **Ship Emissions**
 - One ship = 4 tons pollutants at the dock
 - 16 ships arrive at ports = emissions of 1 million cars
 - Cargo shipment growth = 100% in next 10 years
- **“Cold Ironing”**
 - 4 on West Coast
 - Port of LB pending
- **2010 Potential**
 - Additional emission reductions: 9 tpd NOx, 14 tpd SOx
 - Displace 30 million gals. of diesel annually



Non-Road ZEVs

- **Electric Lift Trucks**

- ZEV market share: approx. 60%
- 70,000 – 90,000 in California today
- Replacing one ICE lift truck (NOx) with a ZEV = removing 60 – 170 cars from California roads



- **2010 Potential**

- Additional emissions reductions: 7.5 – 11 tpd NOx & ROG
- Displace 300 million gals. of fuel annually.



Airport Electric Technologies

- Bag tugs, belt loaders, push-back tractors and preconditioned air units.
- At airports worldwide
 - Chicago, Denver, Dallas
 - European airports
- At warehouses, tug market is 60% electric
- 2010 Potential
 - Additional emission reductions: 3 tpd NO_x + ROG
 - Displace ?? Million gals. diesel.



Non-Road ZEVs

- **Burden/Personnel Carriers, Turf Trucks**
 - ZEV market share: 40%
 - 30,000 in California today
- **2010 Potential**
 - Additional emissions reductions: 3 tpd NO_x and ROG
 - Displace 60 million gals. of fuel annually.



Non-Road ZEVs

- **Sweepers, Scrubbers, Varnishers**
 - ZEV market share: 79 – 98%
 - 125,000 in California today
- **2010 Potential**
 - Additional emissions reductions: 2 – 3 tpd NOx and ROG
 - Displace 30 million gals. of fuel annually.



Lawn & Garden Equipment

- **Total electrics: 7.2 million; 38% market share (residential)**
 - Includes cordless and corded leaf blowers, trimmers, shredders, chainsaws
- **Existing ZEV mower incentives**
 - Four AQMDs have popular rebates to scrap and buy ZEV replacements
- **2010 potential from residential lawn and garden only:**
 - Additional emissions reduction: 7 tpd NOx and ROG
 - Displace 110 million gals. gas per year.



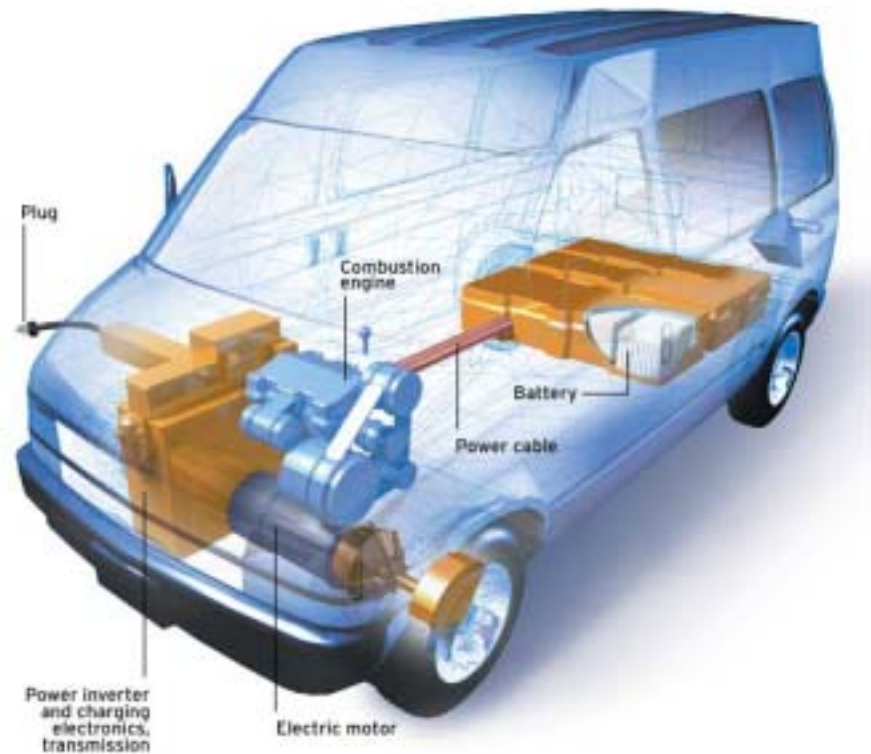
On-Road ZEVs

- **Neighborhood EVs**
 - 10,000+ in California
 - 12 million miles driven
- **ZEV buses and shuttles**
 - About 500 in California
 - Successful programs in Santa Barbara, San Francisco
 - Overhead wire buses in Seattle, Vancouver, 8 others
- **City cars and full-size ZEVs**
 - In commercial fleets, some individual use (1000)



Plug-in Hybrid EVs

- Gasoline-electric hybrid
- Plug in (optional) to recharge
- 20 to 60 miles – pure ZEV range
- EPRI Demonstration
 - 5 DaimlerChrysler Sprinter Vans in early 2005
- Compared to current no-plug hybrids:
 - 25% – 55% reduction in NO_x and ROG
 - 35% – 65% reduction in greenhouse gases
 - 40% – 80% reduction in petroleum



Hydrogen Highway Support



- **Southern California Edison**
 - DOE - FCV and infrastructure demos with Chevron - Texaco/Hyundai
- **Sacramento Municipal Utility District**
 - DOE - FCV and infrastructure demo with Ford/BP
 - Fuel Cell Bus Research Support
- **Pacific Gas & Electric**
 - Hydrogen Infrastructure station in SF using steam reformation of natural gas
- **Los Angeles Dept. Water & Power**
 - 5 stationary fuel cell demos; FCV demos; public hydrogen fueling stations
- **EPRI**
 - Plug-in hybrid fuel cell bus with USDOT



Bringing it all Together: Potential for California

Electric-Drive Technology	Estimated Reductions in NOx + ROG, 2010 – 2015	Estimated Annual Gallons of Fuel Displaced 2010 – 2015
Truck Stop Electrification	29.5 – 65 tpd	45 – 130 million
Truck Refrigeration Units	12 – 17 tpd	30 – 40 million
Ship to Shore Electrification (cold ironing)	23 – 47 tpd (with SOx)	30 – 65 million
Forklifts	7.5 – 15 tons per day	300 – 540 million
Airport Bag Tugs	3 – 5 tpd	Not calculated
Burden Carriers, Turf Trucks	3 – 4 tpd	60 – 80 million
Sweepers, Scrubbers, Varnishers	2 – 3 tpd	30 – 40 million
Residential lawn and garden equipment	7 - 10 tpd (low estimate)	110 – 275 million
EVs (Buses, NEVs, City Cars)	Not calculated	Not calculated
Plug-in HEVs	Not calculated	300 – 1,200 million
Total	87 – 166 tpd statewide	905 – 2,370 million

PM reductions for the above total 1.9 – 2.4 tpd by 2010 to 2015

Recommendations

- **Develop a “California Transportation Fuels Strategy and Implementation Plan” which will achieve CA’s adopted energy and environmental goals.**
- **Include off-road or non-road fuel use, and alternatives.**
- **Count all benefits: NO_x, PM, ROG, CO₂ and fuel diversity.**
- **For electric alternatives, encourage load management and energy efficiency activities/programs.**
- **Include electric transportation and goods-movement equipment into the Energy Action Plan.**
- **Organize/work with stakeholders on an ongoing basis to develop and implement policies, programs, incentives, information and funding.**

Thank You

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